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FLORENCE NIGHTINGALE AS STATISTICIAN.

By Edwin W. Kopf.

The somewhat legendary accounts of this remarkable woman contain but few references to that part of her life and work which should appeal to the students of the history of modern social statistics. More or less is understood of her radical innovations in the nursing care of the sick in institutions and especially in military hospitals; a definite idea exists of her capacities as reformer, administrator, and nurse. Comparatively little is known of her, however, as a constructive compiler and interpreter of descriptive social statistics. One biographer alone, Sir Edward T. Cook, speaks with sympathy and understanding of her as a statistician. He calls her a "passionate statistician."*

The activities of Miss Nightingale in statistics may be classed under several broad categories. We may think of her in terms of her forty years of thought and achievement in the Indian question; in safeguarding the health of the British soldier; in reorganizing civil and military hospital administration at home and abroad; and, in this latter regard, of her pioneer services to the profession of nursing. Her keen intellect, applied to these major projects of her career, comprehended the utility of the statistical method as a means of developing a basis of established fact for social reform.

In early life, Miss Nightingale showed peculiar aptitude for collecting and methodically recording current historical facts. Her observations during the travels of the Nightingales in Europe over the period 1837–1839 are a curious mixture of comment and criticism on the then existing laws, land systems, social conditions, and benevolent institutions. Throughout her life she collected an immense number of pamphlets, reports, and returns which she skillfully analyzed with telling effect in her campaigns for hospital and sanitary reform. Following her nursing apprenticeship with the Fliedners at

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* The writer is indebted to Sir Edward T. Cook's "Life of Florence Nightingale" for abstracts from Miss Nightingale's private papers, and for much of the material in this paper.

Kaiserswerth, she undertook further training at the *Maison de la Providence* in Paris; here she proceeded to collect hospital reports, returns, statistical forms, and general information on hospital construction and sanitation. Among her papers then were elaborately tabulated analyses of hospital organizations and nursing systems and their end results. These inquiries extended to both France and Germany. She seems also to have addressed circulars of inquiry on the same subjects to representative hospitals in the United Kingdom.

Miss Nightingale was profoundly influenced by the works of Adolphe Quetelet, the Belgian astronomer, meteorologist, and statistician. Perhaps her practice of methodically recording the facts of her botanical researches led her to one of Quetelet's laws of flowering plants. The common lilac flowers, he averred, when the sum of the squares of the mean daily temperatures, counted from the end of the frosts, equals 4264^0 centigrade. While this "law" delighted her, she regarded it as a lesser example of Quetelet's researches and statistical conclusions. She was fascinated most by Quetelet's "*Sur l'Homme et le Développement de ses Facultés,*" published in 1835, in which he outlined his conception of statistical method as applied to the life of man. From Quetelet, Miss Nightingale learned much of the science and art which describes human society in terms of numbers. From him she learned the methods, general aims, and results of qualified inquiry into social facts and forces.

MILITARY AND SANITARY STATISTICS OF THE CRIMEAN WAR.

The discipline of Quetelet's new science of social inquiry was to have its first influence upon the military and sanitary statistics of the Crimean War. Miss Nightingale found the medical records of the Scutari hospitals in lamentable condition. Even the number of deaths was not accurately recorded. The three separate registers then maintained gave each a totally different account of the deaths among the military forces. None of the statistical records was kept in uniform manner. She was able to introduce an orderly plan of recording the principal sickness and mortality data of the military hospital establishments which came within the sphere of her influence.

Miss Nightingale's experience in the Crimea filled her with an ardent desire to remedy the scandalous neglect of sanitary precautions in the Army; her study of the available data convinced her that the greater number of deaths in hospitals need not have occurred at all. During the first seven months of the Crimean campaign, a mortality of 60 per cent. per annum from disease alone occurred, a rate of mortality which exceeded even that of the Great Plague in London, and a higher ratio than the case mortality of cholera. Miss Nightingale's vigorous use of these facts resulted in a series of reforms, which in turn reduced this terrible rate of mortality. She observed, also, that if sanitary neglect prevailed in the Army afield, it probably affected the Army at home in considerable degree likewise. She compared the mortality in civil life with the mortality in army barracks. Between the ages of 25 and 35 she found that the mortality among soldiers was nearly double that in civil life. In writing to Sir John McNeill she said: "it is as criminal to have a mortality of 17, 19, and 20 per thousand in the Line, Artillery and Guards, when that in civil life is only 11 per 1,000, as it would be to take 1,100 men out upon Salisbury Plain and shoot them."

Her further observations on the Chatham military hospitals were: "This disgraceful state of our Chatham Hospitals is only one more symptom of a system, which, in the Crimea, put to death 16,000 men—the finest experiment modern history has seen upon a large scale, viz., as to what given number may be put to death at will by the sole agency of bad food and bad air." Among her private notes of 1856 her biographer found this: "I stand at the altar of the murdered men, and while I live, I fight their cause." The one weapon upon which she placed most dependence was her collection of sanitary statistics.

HEALTH, EFFICIENCY, AND HOSPITAL ADMINISTRATION OF THE BRITISH ARMY.

The results of her personal studies of army medical statistics were embodied in a report, from the first intended as a confidential communication to the War Office and the Army Medical Department. There had been considerable delay in the formation of the Royal Commission on the health of the Army which she had requested in her November, 1856, interview with Lord Panmure. The Royal Warrant establishing the Commission was not issued until May 5, 1857. During this exasperating period of delay Miss Nightingale held in reserve her array of statistics, until, having begun her agitation with the sovereign and continuing through the politicians, she was almost ready to plead her cause with the people. In three months from the day the Royal Warrant was issued, the Commission presented its report. In the meantime, Lord Panmure had asked Miss Nightingale for her "Notes Affecting the Health, Efficiency and Hospital Administration of the British Army." These notes are the least known of her works, because they were never officially published. It has never become known how much of the final Report of the Royal Commission was actually the work of Miss Nightingale. Printed at her private expense and circulated among influential people, her "Notes" made a profound impression. They have been termed "a treasury of authentic fact . . . affording a complete elucidation of the causes which had brought about failure, and showing the means by which the country could best hope to safeguard the truly sacred task of providing for the health of its troops in future wars." Another of her friends who read the proof said: "It has so much the character of good, sincere, enlightened conversation on a subject which is thoroughly understood and appreciated, and so little the appearance of having been 'got up' or of pretension of any kind, literary or artistic." Another reader said: "I regard it as a gift to the Army, and to the country altogether priceless."

The preface to the Notes gave the keynote. Hospitals were shown to be but part of wider programs involving the general health and efficiency of the Army. This was emphasized by the fact that those who fell before Sebastopol by disease were above seven times the number who fell by the enemy. The introductory chapter gave the history of the health of the British Armies in previous campaigns. Six of the twenty sections of the Notes dealt with the medical history of the Crimean War. Two other sections discussed the mortality of armies in peace and war and the necessity for a statistical department of the army. There were also numerous appendices, supplementary notes, and graphic illustrations and diagrams.

PIONEER IN GRAPHIC ILLUSTRATION OF STATISTICS.

It must be remembered that these Notes were written by Miss Nightingale in the short space of six months, and while in delicate health. In the preparation of her report she had but little assistance; the gathering of the data was facilitated, however, by the friendly coöperation of many broadminded men in the public service. Dr. Farr, for instance, aided materially in the preparation of the comparisons between the mortality of civil and army life and in editing the graphical illustrations which he especially commended. These graphical diagrams were at that time somewhat of an innovation in statistics, and had no significant precedent save in the statistical works of A. M. Guerry, a contemporary of Quetelet. The Report of the Commission, containing some thirty-three written answers by Miss Nightingale to leading questions by the Commission, together with her original tabulation of the appalling morbidity and mortality statistics of the British Army, was issued to the public in January, 1858. The graphical illustrations in her own Notes portrayed, by means of shaded or colored squares, circles and wedges, (1) the deaths due to preventable causes in the hospitals during the Crimean War and (2) the rate of mortality in the British Army at home. "Our soldiers enlist," as she put it, "to death in the barracks." She reprinted this graphic section and distributed it, with a brief memorandum, to leading members of Parliament and to medical and commanding officers throughout the country, in India, and in the Colonies. "It is our flank march upon the enemy," she said.

STATISTICAL DEPARTMENT OF BRITISH ARMY FOUNDED.

The chief product of the Commission's work of interest from the statistical standpoint was the report of the subcommittee on Army Medical Statistics. This committee, consisting of Mr. Sidney Herbert, Sir A. Tulloch, and Dr. Farr, reported in June, 1858, and published its "First Annual Statistical Report on the Health of the Army" in March, 1861. The compilations were directed by Dr. Thomas Graham Balfour, under whose leadership British army statistics became the best and most useful obtainable in Europe.

The facts published in the "Notes" did not go unchallenged. A pamphlet appeared anonymously calling them in question. Miss Nightingale immediately prepared a reply. This second note was entitled "A Contribution to the Sanitary History of the British Army during the late War with Russia," and constituted a scathing and eloquent account of the preventable mortality which she had witnessed in the East. The graphic charts of the "Notes" were reproduced.

CONSTRUCTION, ORGANIZATION, AND MANAGEMENT OF CIVIL HOSPITALS.

The opposition to the recommendations of the subcommission on Army Barracks stimulated Miss Nightingale to prepare a more extended discussion of hospital construction, organization, and management. From her extensive experience in and study of hospital systems in Germany, France, and Ireland and in the Crimea, she prepared two addresses on hospital construction and sanitation for the Liverpool meeting of the National Association for the Promotion of Social Science. These papers were reprinted as "Notes on Hospitals." These "Notes" in three editions, the last in 1863, revolutionized ideas of hospital construction.

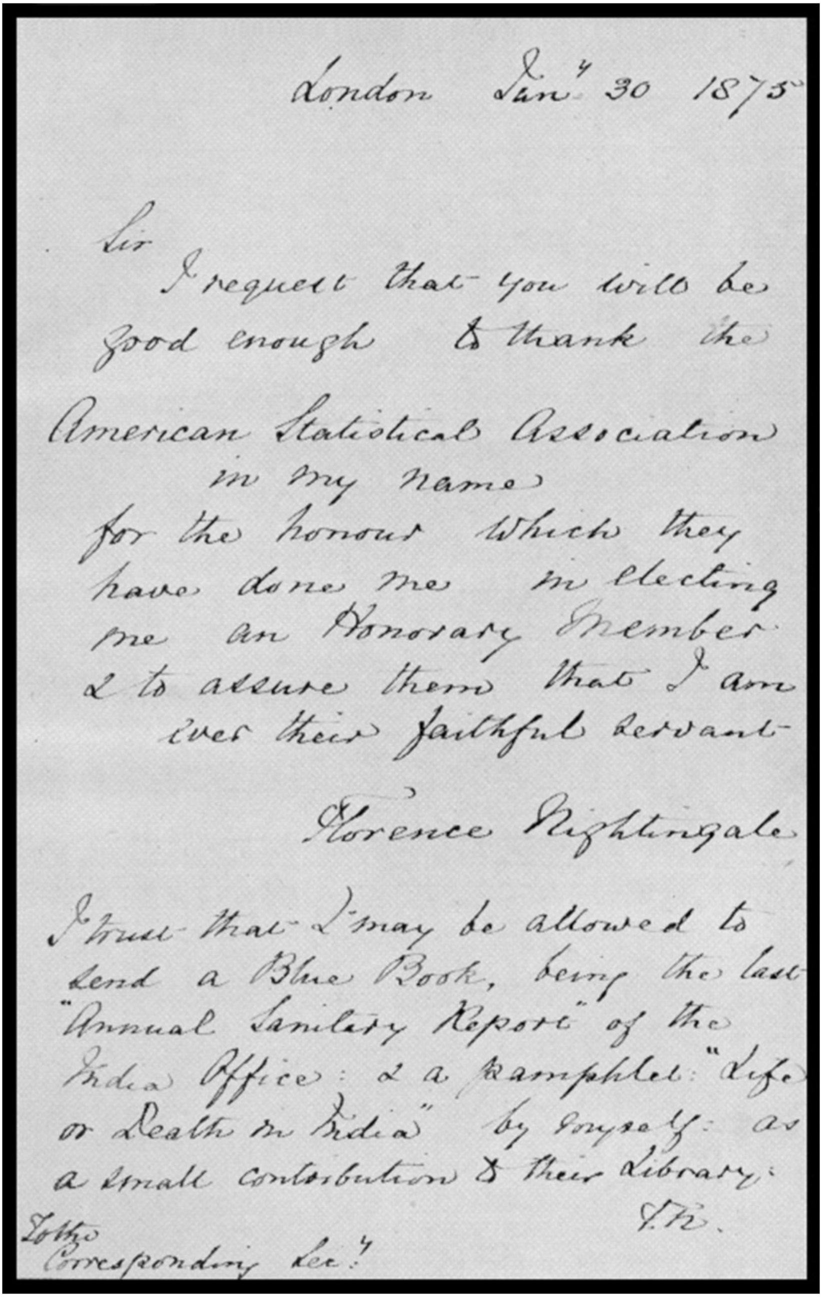
It was pointed out that the hospital statistics then available gave little information of real value on the proportion of recoveries, of deaths, and the average duration of hospital treatment for different diseases, duly qualified by sex and age. A common agreement on the number and nature of statistical data to be tabulated was recommended. A unique feature of this Liverpool address was a mortality table for hospital nurses and attendants showing the greatly increased prevalence of communicable diseases among this class of hospital employees, as compared with the mortality from the same causes in civil life. The deplorable existence of "hospital gangrene" and "hospital septicemia" in that day of defective hospital sanitation and construction was effectively portrayed by these mortality statistics.

A brief inquiry into the precedent circumstances will be of interest. When Miss Nightingale returned from the Crimea she directed much thought and attention to hospital statistics as an adjunct to administration of institutions for the care of the sick. She found a complete lack of scientific coördination. The statistics were not kept along uniform lines. Each hospital followed its own nomenclature and classification of diseases. The available data had never been tabulated upon forms which would render the statistics of one hospital comparable with those of another. The data had little value for advancing medical knowledge or as an adjunct to hospital management. With the assistance of Dr. Farr, and of other friendly physicians, she drew up a standard list of diseases (largely a selection from the d'Espine-Farr System) and a set of model hospital statistical forms. She had her model forms printed in 1859 and persuaded some of the London hospitals to adopt them experimentally. She and Dr. Farr studied the tabulated results, which had sufficient value to show how large a field of qualified statistical inquiry had been opened by the introduction of her forms.

Miss Nightingale's skill in so effectively employing the statistical method in army sanitary reform had led to her election, in 1858, to fellowship in the Royal Statistical Society. On October 16, 1874, the American Statistical Association elected her an honorary member. A photographic reproduction of her letter of acceptance appears on the following page.

INTERNATIONAL STATISTICAL CONGRESS OF 1860.

This growing association with the leaders of thought in the statistical world of her time enabled her to take an active part in drawing up the program of the second section of the International Statistical Congress, held at London in 1860. This Section dealt with sanitary statistics. Miss Nightingale and Dr. Farr incorporated the forms for uniform hospital statistics, which had been experimentally introduced into a group of London hospitals in 1859, in a paper read for her before the Section by Dr. McMillian. Additions and recommendations,



London Jan^{y} 30 1875

Sir

I request that you will be good enough to thank the American Statistical Association in my name for the honour which they have done me in electing me an Honorary Member & to assure them that I am ever their faithful servant

Florence Nightingale

I trust that I may be allowed to send a Blue Book, being the last "Annual Sanitary Report" of the India Office: & a pamphlet: "Life or Death in India" by myself: as a small contribution to their Library:

F.N.

To the Corresponding Sec^{y}

chiefly by Dr. Berg of Sweden and Dr. Neumann of Berlin, were concurred in by the author in a letter to the Earl of Shaftesbury, President of the Section.

This paper on uniform classifications and forms for hospital statistics was afterward widely circulated among physicians and hospital officials. Large quantities of the forms were supplied to hospitals in various parts of the country. The Paris hospitals took up the plan. Guy's Hospital, London, prepared a statistical analysis of its experience for the years 1854 to 1861; St. Thomas' for the years 1857 to 1860; and St. Bartholomew's, for 1860. At a meeting held at Guy's Hospital on June 21, 1861, it was unanimously agreed to adopt a uniform plan of registration, that each hospital should publish its own statistics annually, and that the forms devised by Miss Nightingale should be used so far as practicable.

ELEMENTS OF HOSPITAL MEDICAL STATISTICS.

Miss Nightingale then prepared the detailed paper on "Hospital Statistics and Hospital Plans" for the Dublin meeting of the National Association for the Promotion of Social Science in 1861. In this paper she emphasized the seven primary tabulation elements of hospital sickness statistics, which were:

(1) Number of patients remaining in hospital on first day of year.

(2) Patients admitted during year.

(3) Patients recovered or relieved during the year.

(4) Patients discharged as incurable, unrelieved, for irregularities or at own request.

(5) Patients died during year.

(6) Patients remaining at end of year.

(7) Mean duration of cases in days and fractions of a day.

These tabulation "elements" were to be compiled as seven separate tables, each showing diseases classified thereunder by sex and age (by single years under five and by five year periods thereafter). The additional consideration of diseases contracted in hospital while under treatment was also provided for. These extensions of the original paper were suggested by Drs. Berg and Neumann. Miss Nightingale held that these supplementary tables would bring out the fact of the then scandalous prevalence of "hospital diseases" such as gangrene and septicemia.

The statistics of the various hospitals adopting her forms were published in the *Journal* of the Royal Statistical Society for September, 1862. Miss Nightingale's system of uniform hospital statistics was never generally successful over any considerable period of time. The plan, but partly realized in the requirements of the King's Hospital Fund, demands for its complete and effective operation a more intelligent appreciation of and a finer enthusiasm for statistical facts than is afforded even by present day voluntary and competitive hospital systems in metropolitan districts.

A further example of Miss Nightingale's use of the statistical method in hospital economy was her study of the questions relating to the possible removal of St. Thomas' Hospital at the instance of the Southeastern Railway. The railway company proposed the removal of the hospital to provide for an extension of the right-of-way from London Bridge to Charing Cross. She analysed the origins of cases served by the hospital, tabulated the proportions of cases within certain radial distances, and showed the probable effect upon patients of the removal of the hospital to the several possible sites suggested. This method of fitting hospital accommodation to the needs of populations has only recently been revived. It represents a legitimate application of demographic principles to the study of the relief of dire human needs.

The statistics of surgical operations from the standpoint of hospital cost and practical end results were next considered by Miss Nightingale. In a commentary on St. Bartholomew's statistical report, Miss Nightingale outlined the minimum requirements of a report form for the nature and result of surgical operations. The subject was further developed in a paper read for her before the Berlin meeting of the International Statistical Congress in 1863.

Before the close of the London meeting of the International Statistical Congress, 1860, Miss Nightingale addressed a letter to Lord Shaftesbury. The letter was read to the whole Congress and adopted by it as a resolution. The resolution impressed upon governments the prime necessity for publishing more extensive and numerous abstracts of the statistical information in their possession.

MISS NIGHTINGALE AND THE CENSUS OF ENGLAND, 1861.

Miss Nightingale made a determined effort to extend the scope and application of the Census of 1861, largely in the direction of collecting statistics which would serve as a foundation for sanitary reform. Her aim was twofold: one was to enumerate the sick and infirm on Census Day. To those who denied that it could be accomplished, she pointed out that it had been done elsewhere, notably in Ireland. Her second ambition was to obtain complete data on the housing of the population; this, too, had been practicable in Ireland, she urged. In pressing her point with the Census officials she said: "The connection between the *health* and the *dwellings* of the population is one of the most important that exists. The 'diseases' can be approximated also. In all the more important—such as smallpox, fevers, measles, heart disease, etc. —all those which affect the *national* health, there will be very little error. Where there *is* error in these things, the error is uniform . . . and corrects itself. . . . " These few remarks still serve as prolegomena to any future census plans for England or any other country.

The Census Bill came up late in the session and not much comment can be found on the foregoing suggestion for a development of Census inquiry. The only critical comment made in the debate proceeded from Lord Ellenborough, who, far from considering the innovations of sickness and housing statistics, proposed to exclude most of the inquiries already suggested. Miss Nightingale, in her conception of census methods and results, was far ahead of her day and generation. Subsequent censuses, chiefly in the United States, in Tasmania, and in one or two other countries, have included sickness and housing inquiries.

SCOPE AND USE OF STATISTICS.

Miss Nightingale's activities in furthering statistical progress were the outgrowth of her deep conviction, variously expressed in her several papers, that the social and moral sciences are in method and substance statistical sciences. In her several papers on metaphysical topics, she asserts that statistics were to her almost a religious exercise. Her conception of theology was that its true function was to ascertain the "character of God." Statistics, she mused, discovered and codified law in the social sphere and thereby revealed certain aspects of "the character of God." Doubtless, in these speculations she was profoundly influenced by the studies of Quetelet in moral statistics, as typified in his "*Recherches statistiques sur le Royaume de Pays-Bas.*"

Statistics as an element in political education also appealed with peculiar force to Miss Nightingale. In a letter to Benjamin Jowett she said: "The Cabinet Ministers, the army of their subordinates . . . have for the most part received a university education, but no education in statistical method. We legislate without knowing what we are doing. The War Office has some of the finest statistics in the world. What comes of them? Little or nothing. Why? Because the Heads do not know how to make anything of them. Our Indian statistics are really better than those of England. Of these no use is made in administration. What we want is not so much (or at least not at present) an accumulation of facts, as to teach men who are to govern the country the use of statistical facts."

She proposed a number of leading questions which she desired to see investigated by the statistical method: What had been the result of twenty years of compulsory education? What is the effect of town life on offspring in number and in health? What are the contributions of the several social classes to the population of the next generation? In proposing these inquiries she anticipated by more than a generation the work of the eugenists and biometricians of the Galton-Pearson school. Her friend, Adolphe Quetelet, had inaugurated studies of this character. Both he and Dr. Farr had hoped that she would pursue her inquiries more extensively. In conversation with Benjamin Jowett she proposed to found at Oxford a Professorship or Lectureship in Applied Statistics. Mr. Jowett seems to have discussed the matter with Mr. Arthur Balfour and Professor Alfred Marshall. Miss Nightingale, on her part, consulted Mr. Francis Galton, who responded earnestly and worked out a detailed plan. There was more or less discussion over the matter, but in the press of other affairs, the proposition was discarded. It is certainly of very great interest in this connection to observe that many years afterward such an enterprise was undertaken by the University College in London; probably, however, not directly issuing from Miss Nightingale's suggestion.

VITALITY OF ABORIGINAL RACES.

Following her disquisitions on army, medical, and civil hospital statistics, came her statistical investigations into colonial questions: the first into the vitality of native or aboriginal races in the Colonies; the second into the sanitary condition and material welfare of the population and military establishment of India. In a paper before the National Association for the Promotion of Social Science, meeting at Edinburgh in 1863, she discussed the gradual disappearance of the native races when brought into contact with the influences of civilization. The paper was suggested by Sir George Grey, who, at that time, was deeply engaged with questions of Colonial policy. The preliminary inquiry related to the probable effect of European school usages and school education generally, upon the health of children, of parents, and of races which had not heretofore been brought under any system of education. With the assistance of the Duke of Newcastle, she prepared a form which was sent by the Colonial office to the governors of the various colonies. From the returns of 143 schools she deduced the mortality of school children by age period and by sex, and further classified the statistics by causes of death. A second inquiry into the statistics of colonial hospitals gave important information on the causes of high institutional mortality among the native races. The numbers involved were small, and the results were necessarily considerably in error; but, in the main, the conclusions as to the neglect of sanitary precautions and the change in the living habits of native races were sound.

A further paper on the aboriginal races in Australia was read before the same Association at York, England, in 1864. This essay contained copious quotations from correspondence with colonial governors over points raised by the first paper. The Colonial Office circulated the reprint of the Edinburgh paper widely. Miss Nightingale has been considered a pioneer in work for arresting the decline of native races, so far as such work has been possible.

BRITISH ARMY IN INDIA.

After the death of Sidney Herbert, Miss Nightingale devoted the larger portion of her time and attention to the Indian question. Her earlier years of service to the British Army at home were not more significant than her later years of endeavor for the army and people in India. The greater proportion of the lives of soldiers lost in India was not chargeable to battle, but to disease caused by insanitation and general ignorance of military tropical hygiene. In 1859, it was found that the average annual death rate of the British armies in India had been 69 per 1,000 since the year 1817.* In recent times the figure has been 5 per 1,000. The changes in living and working accommodations which brought about this reduction in army mortality are directly traceable to the recommendations of the Royal Commission, appointed in 1859, which reported in 1863. An unrecorded fact, however, is that Miss Nightingale's suggestion led directly to the appointment of the Commission and that the greater part of the Report was her handiwork. The suggestions upon which permanent reforms in army sanitation in India were based were also her work.†

For eight months, during the latter part of 1858 and the earlier part of 1859, Miss Nightingale importuned Lord Stanley for the appointment of a Royal Sanitary Commission which would do for the armies in India what had been done for the armies at home. She had contemplated for two years before, the appointment of a Commission to investigate the entire question of the armies in British India. The mutiny of almost the whole of the Bengal native army and the contingents in northern India in 1857, which had filled the minds of the British population with thoughts of vengeance and repression against the native army, had only served to fix her attention upon sanitary and other administrative reform on behalf of the soldiers. Her analysis of the statistics of army mortality in India convinced her that there was murder committed not by the Sepoys alone. To her mind, it was murder to doom British soldiers to death by neglect of the most elementary sanitary precautions.

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* While this figure included battle casualties of the campaigns of the forty years ending with 1856, the mortality figure was still excessive. It was stated that the registered mortality among British troops in India was six times that of Englishmen of the same ages at home. Again, in an earlier investigation into mortality from disease among troops in the East Indies (including for the most part British India) death rates varying from 40 to 98 per 1,000 of mean strength over the period 1840–1848 were found.

† British soldiers in India today live in barracks which surpass in comfort and sanitation any that can be found in other countries. Every regiment, battery, and depot has its regimental institute, a sort of soldiers' club, library, reading and recreation room, a temperance association, and a theatre. The use of alcoholic beverages is discouraged and every encouragement is given to useful employment for the men.

Anticipating the appointment of the Commission, she began collecting, tabulating, and interpreting data she derived from circulars of inquiry which she had drafted and sent to all the stations in India. The inquiry form lacked little in requisite completeness and precision of detail. In the meantime, Miss Nightingale and Dr. Farr searched the sickness and mortality records of the India Office.

The report of the Indian Sanitary Commission when issued in 1863 comprised in all 2,028 pages, mostly in small print. The greater part of the statistical work in the Report bore clear evidence of Miss Nightingale's influence. Her inquiry blank, in the first instance, provided the vehicle for the transmission of much of the evidence. The replies to her questions occupy the whole of the second volume of the Report. In October, 1861, the Commission requested her to submit her interpretation of these Stational Reports. Her observations upon these reports occupied 23 pages and are the most remarkable of her published works. Her unusual treatment of the subject by the addition of illustrative wood-cuts describing Indian hospitals and barracks, made the Treasury demur, however, at the cost, but Miss Nightingale was permitted to pay for the printing out of her private purse. Copies of these observations were sent to the queen and to influential members of the government. Sir John McNeill wrote: "The picture is terrible, but it is all true. There is no one statement from beginning to end that I feel disposed to question and there are many which my own observation and experience enable me to confirm." In detail, her notes related to the camp diseases which follow the selection of poor sites, defective disposal of human wastes, overcrowding in barracks, lack of suitable occupation and exercise, dietaries and defective hospital arrangements. The sources of statistical data for the armies in India were also criticised. In addition to her observations, Miss Nightingale prepared with Dr. Sutherland an abstract of the returns upon which her "Observations" were founded.

Moreover, when the Report was published she moved with her characteristic decision to secure for it the newspaper and periodical publicity which it deserved. She contributed a popular résumé of the Royal Commission's Report to the National Association for the Promotion of Social Science, meeting at Edinburgh in 1863, entitled "How People may Live and not Die in India." The paper was republished in 1864, with a preface and an account of what the Commission had actually achieved in sanitary works and measures. In 1868, the Secretary of State printed her résumé of the Indian Sanitary Question from 1859 to 1867 and her memorandum of advice and suggestions on the entire situation as it then stood. The dispatch from Sir Stafford Northcote under date of April 23, 1863 (drafted by Miss Nightingale), was printed at the same time. This dispatch resulted in the first of the annual series of Indian Sanitary Reports. In the reports for 1868 and 1869 appear two of Miss Nightingale's contributions; in the first an Introduction of eight pages and in the second her paper on "Sanitary Progress in India."

Her statistical enterprises of this period are well summarized in a few phrases which are here quoted from one of her letters: "I am all in the arithmetical line now . . . I find that every year . . . there are in the Home Army, 729 men alive every year who would have been dead but for Sidney Herbert's measures, and 5,184 men always on active duty who would have been 'constantly sick in bed.' In India the difference is still more striking. Taken on the last two years, the death rate of Bombay is lower than that of London,* the healthiest city in Europe. And the death rate of Calcutta is lower than that of Liverpool and Manchester. But this is not the greatest victory. The Municipal Commissioner of Bombay writes that the 'huddled native masses clamorously invoke the aid of the Health Department if but one death from cholera occurs; whereas formerly half of them might be swept away and the other half think it all right.'"

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*These figures related only to conditions prevailing at the time this letter was written.

In 1873, the National Association for the Promotion of Social Science invited her to contribute a paper on the ten years of progress in India since her "How People may Live and not Die in India" paper appeared. Her title for this later paper was "How some People have Lived and Not Died in India." The India Office reprinted the paper in its 1874 bluebook. The salient fact developed in this report was that the death rate in the Indian Army had been reduced from 69 per 1,000 to 18 per 1,000. This summary of ten years of sanitary progress in India she was qualified to prepare in consequence of her editorial work on the annuals issued by the sanitary department of the India Office.

In 1877, Miss Nightingale published two letters on famine in India and followed these by an article in the *Nineteenth Century* magazine. This article, "The People in India," gave the principal facts about the Indian famines and proceeded further to describe in considerable detail the evils of usury in the Bombay Deccan. Beginning with 1874, Miss Nightingale collected statistics of irrigation in India, and of the effect of irrigation on the life and health of the people. These data, the appendix of the second part of an unpublished work on the Indian Land Question and Irrigation Systems, were afterward partially used in several isolated papers. She thought much on education in India. There had been a neglect of elementary education. The exception was found in the system of village schools established by Lieutenant-Governor James Thomason, of what is now the Agra Province. The report of the Indian Education Commission of 1883 directed attention to the essential difficulties residing in the language, credal, race, and traditional differences of the populations of the several provinces. The two chief difficulties in the way of a diffusion of education among the masses in India are the large agricultural population, among whom it is in all countries difficult to advance any system of education, and the existence of a hereditary class, whose object has been to maintain their monoply of learning as the chief buttress of their social supremacy. Questions such as these occupied Miss Nightingale's attention in the years 1881 and .1882.

The succeeding years were taken up in turn by Army Hospital Service reform, district nursing organization, nursing education and Indian finance problems.

In 1891 Miss Nightingale finally laid aside her ambition to found at Oxford a Professorship in Applied Statistics. This relinquishment of active interest in the progress of statistics was indicative only of her failing physical powers. The gradual failure of sight, memory, and mental apprehension proceeded during the last fifteen years of her life. Her death occurred on August 13, 1910.

FLORENCE NIGHTINGALE AS STATISTICIAN.

Florence Nightingale may well be assigned a position in the history of social statistics next to those occupied by Quetelet and Farr. Her ardent, genuine sympathy for the sick and distressed was greatly augmented by a positive genius for marshalling definite knowledge of the forces which make for disease and suffering. The same intellect which sharply separated the formulae, procedures, and practical methods of nursing from its abiding principles as one of the humanities, also discerned the statistical facts of sickness and other forms of disharmony between the individual and his environment. In hospital care of the sick, as an instance, Miss Nightingale replaced the astigmatic case viewpoint with one embodying a grasp of total situations. This is one function of statistics.

Her earnest perception of this truth—an essential in the equipment of the statistician—was firmly supported by her control over laborious detail and by her scrupulous care in testing the statistical foundations of her premises. The interpretations she placed upon the facts developed in her researches show a careful regard for the competent counsel which she so often consulted. In all these respects Miss Nightingale exhibited the prime qualities of one thoroughly versed in the art of preparing and reflectively analysing social data.